

```

&option
  tmax=2400.0 ntgraf=5  stepsz=0.750 start=.t. tsave=480.0
  restartFileNumber=1
/

&earth
  xdip=0.00001 ydip=0.00000 zdip=0.000000 rearth=6.0
  tilt1=-90.0 tilt2=-90.0 tilting=.f.
  rmassq=1. rmassh=1. rmasso=16.
/

&speeds
  cs_inner=0.055 alf_inner1=0.177 alf_inner2=0.177 alpha_e=6.0
  den_earth=200. o_conc=0.05 gravity=5.0 ti_te=5.
  gamma=1.6666 ringo=.f. update=.f. reload=.f.
/

&windy
  re_wind=35. cs_wind=0.015 vx_wind1=0.40 vx_wind2=0.40
  vy_wind1=0.000 vy_wind2=0.000 vz_wind1=-0.00 vz_wind2=-0.00
  alfx_wind1=0.00005 alfx_wind2=0.00005
  alfy_wind1=-0.00 alfy_wind2=-0.00
  alfz_wind1=0.063 alfz_wind2=0.063
  den_wind1=3.5 den_wind2=3.5
  reynolds=12.0 resist=12. rho_frac=0.002
  bfrac=1.0 vfrac=1.0
/

&physical
  re_equiv=0.444 b_equiv=65.75 v_equiv=1000. rho_equiv=2.
  spacecraft=.f. warp=.f. utstart=0.0
/

&smooth
  chirho=2.0 chipxyz=2.0 chierg=2.0
  difrho=0.005 difpxyz=0.005 diferg=0.005
/

-36.  52.  -24.  24.  -24.  24.  1.  2  0
-64. 112. -48.  48.  -48  48.  2.  3  1
-120. 232. -96.  96.  -96  96  4.  4  2
-160. 544. -192. 192. -192 192  8.  0  3

                                ncore      nbdry
                                m = small    m=big
                                ncore = big   nbdry=small

Restart from oxz111 for hightime resolution movie

tmax = total duration in sim units - 300 units is about 30 mins
ntgraf is number of graphical outputs per run
stepsz : fraction of the maximum of courant conditions
start : true if initializing a new run
        false if looking up restart data

```

tsave : time steps between saving restart data

position of the earth given by xdip,ydip,zdip ! don't change  
can't be exactly at a grid point due to dipole approximation  
rearth: radius of inner boundary - this with re\_equiv sets how many  
earth radii out

dipole tilt : earth magnetic field will tilt from titl1 to tilt2 (in degrees)  
over the sim period (opposite to GSM angle)  
tilting true gives variable tilting; false fixed tilt angle

mass different species: q refers to the solar wind  
h ionospheric ions  
o heavy ionospheric ions  
rmassq mass of the solar wind ions : 1 for protons  
rmassh ionospheric protons  
rmasso mass of heavy ions : 16 for oxygen

Specification of Earth inner boundary

cs\_inner : sound speed at the equator in sim units! code  
automatically makes the polar regions colder than equator  
alf\_inner: Alfven speed at the equator in sim units! requires  
den\_earth: equator density in sim unit (use rho\_equiv to convert to real units  
proton density  
assymteries in in density over polar cap is hard coded as the parameter  
ar\_iono in code symmetric is  
ar\_iono=sqrt(xp\*\*2+ay\*\*2+zp\*\*2)  
4 to 1 anisotropy with less density at the equator  
ar\_iono=sqrt(xp\*\*2+ay\*\*2+2.\*zp\*\*2)  
alpha\_e don't change - specifies initial falloff of plasmasphere

O\_conc percent concentration relative to proton density  
gravity is at inner boundary in m/s/s  
ti\_te is the ion to electron temperature ratio  
gamma is polytropic index = 5/3

ringo does not do anything

update = change zero clock time - false no change  
reload = updates unperturbed quantities used for diffusion for stability of  
code  
- least numerical diffusion for true  
but code can be unstable

Solar wind parameters are in windy  
uses user specified quantities if spacecraft = .f. and uses  
spacecraft specified data if true

re\_wind is unimportant ! how many grid points in for solar wind start  
cs\_wind sound of wind: not critical  
all other wind parameters change 1 from 2 over the sim period

Reynolds is grid spacing/ion skin depth (for protons assuming unit sim density)  
Resist is collisional reynolds number at the ionosphere  
Any small numbers than 12 code tends to go unstable  
ideal Ohms law for large Reynolds  
rho\_frac oxygen density can't be zero anywhere have to put a very small  
about of 0 in solar wind

bfrac and vfrac are useless parameters

warp - is want a variable Bx in IMF requires warped flow of solar wind into  
system

re\_equiv is the number of Re that a grid unit corresponds to  
v\_equiv is what a normalized velocity of 1 sim unit is in km/s  
sim time step of 1 needs that something with 1 sim vel goes one grid unit  
in 1 tim sim unit  
rho\_equiv is in  $\text{cm}^{-3}$   
b\_equiv in nT

t=1 is sec is re\_equiv/v\_equiv  
Utstart is start in real time in UT

Smooth  
standard coeffs for lapidus/local diffusion operators ! don't need to change

Numbers are a grid system for box in box  
in grid units  
xmin,xmax,ynmin,ymax,zmin,zmax grid spacing ncore nbdry  
ncode is the number for the box it will provide inner bdry  
conditions  
ndry box that provides inner boundary conditions

Dimensions of grids in parameter statment in main code (1-nx)

nx=89,ny=49,nz=49,nt=8,ngrd=4,ncraft=4,ncts=1172

number of boxes ngrd  
nt = 2\*ngrd !required

if you want more boxes change ngrid but need to aslo change occurrences of (4)  
in  
common statements to new number

Fixed spacecraft probes - total number presently set at 4

ncts is the number of data points in spacecraft data file if spacecraft is true